Space Weather Technical Forecast

Issued on Sunday, 04 August 2024 at 13:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-flares expected, chance of X-flares and of exceeding S1/Minor Radiation Storm threshold. Possible glancing CME influence early Day 1 (04 Aug). Chance of G1/Minor Geomagnetic Storm.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is High. A peak impulsive flare of M7.3 was observed at 03/1839 UTC from AR3775 in the northeast, and a M5.3 flare was observed at 03/1930 UTC from a sunspot just around the east limb, probably originating from Ex-3744, which is due to rotate onto the disc in next day or so. These two M-flares produced R2 radio blackouts. No CMEs are currently evident in coronagraph imagery from these two events.
There are 12 sunspot regions currently on the visible disc. Recently emerged AR3780 appears to be large with multiple spots and will be closely monitored as it rotates further into view. Near the southwest limb, AR3765 and AR3767 remain clustered close together. AR3765 has rotated off the visible disk. AR3772 in the southeast maintains a strong delta in one of its intermediate spots. AR3774 in the southeast quadrant has lost its delta configuration. AR3777 has continued to develop with signs of minor growth in its trailing spot. All other regions appear generally stable at present.

No Earth directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, has remained at background levels below 400km/s. Density has been largely below average. The Interplanetary Magnetic Field, Bt, was initially weak, but gradually increased to Moderate, peaking at 15nT. The north-south component, Bz, was weak for much of the period before becoming moderate with a southward (down to -15nT) orientation from around 04/0600UTC. Phi angle was largely positive (away from the Sun) before rotating into a negative (towards the sun) orientation from 04/0900 UTC. Geomagnetic activity was Quiet to Unsettled (Kp 2-3) before increasing to Active Kp4 between 0300-0600UTC with a revised minor geomagnetic storm Kp5 (G1) between 04/0600-0900 UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels. The 24-hour fluence was below the Active threshold with 1.2e6 integrated pfu observed at 04/0000UTC.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

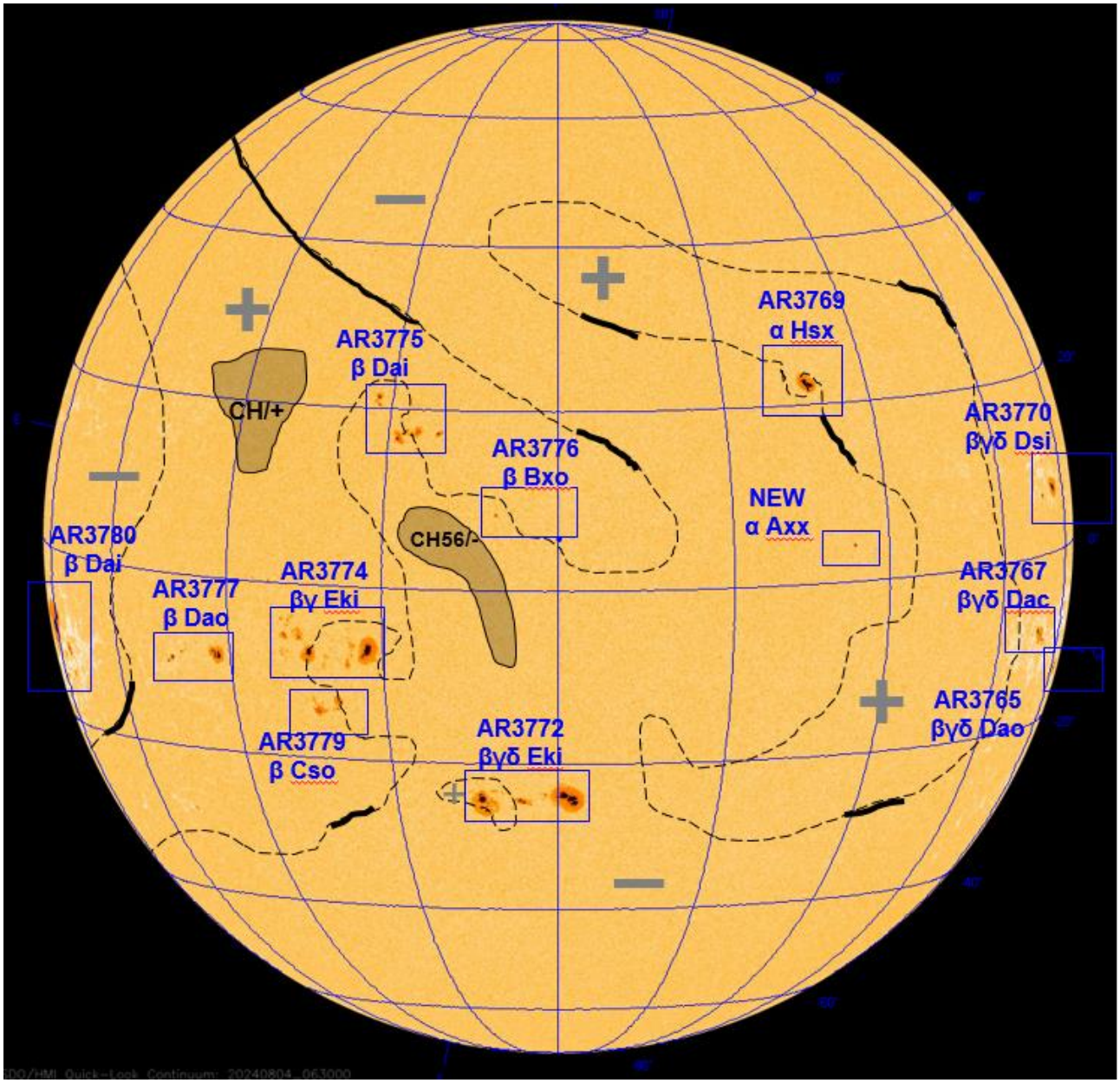
Solar Wind /Geomagnetic Activity: The shock from a CME originating from AR3768 at 01/0709UTC may have arrived as a weak feature during the first half of the 4th August UTC day. Due to the large number of coincident CMEs in recent days, further arrivals cannot be ruled out through the period.
No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active to G1/Minor Storms with a Slight Chance of G2/Moderate Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Energetic Particles / Solar Radiation: High energy proton flux is currently at background levels. Should any notable flares occur in the western disc there is a chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be mostly at background levels, although perhaps rising later in the period if CME influence wanes. The associated 24-hour fluence is likely to remain below the Active threshold (1e8 integrated pfu), with a slight chance of exceeding by the end of the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1. Solar Analysis Valid 04/0700 UTC.



.

Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

The bulk of a broad CME from the M8.2 flare at 01/0709UTC from AR3768 is largely passing ahead of Earth, as indicated by Enlil. However, SOHO coronagraph imagery showed a partial halo shock (not modelled in Enlil), which may have given Earth some weak glancing influence early on Day 1 (04 Aug).

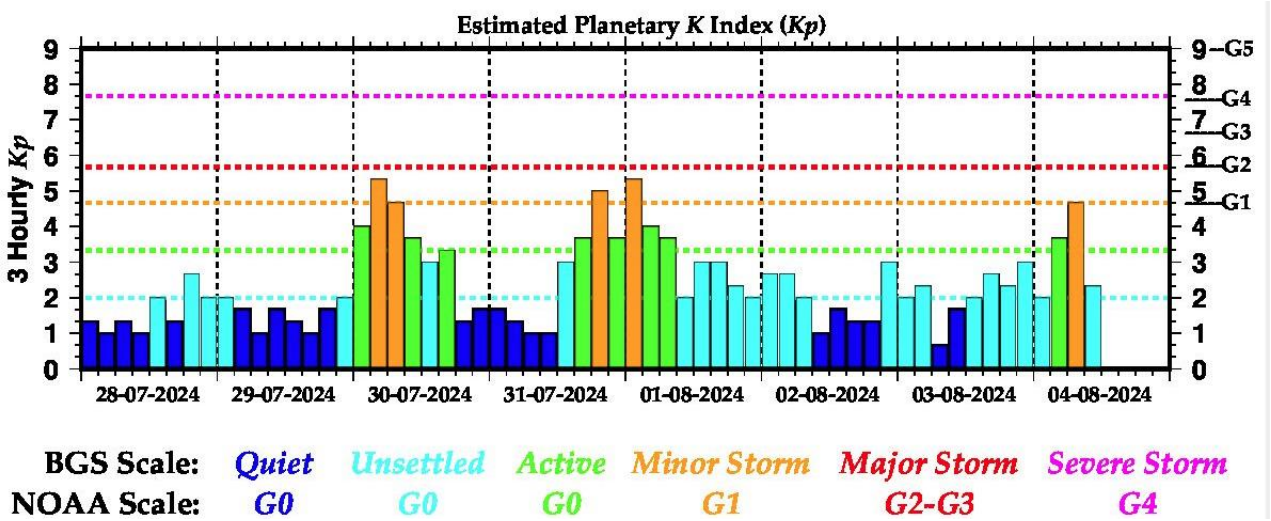
Due to the large number of coincident CMEs in recent days, including those off the Earth-Sun line, analysis has been more difficult than usual. Consequently further arrivals cannot be ruled out through the period.

No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active to G1/Minor Storms with a Slight Chance of G2/Moderate Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	10	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Estimated Planetary Kp



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

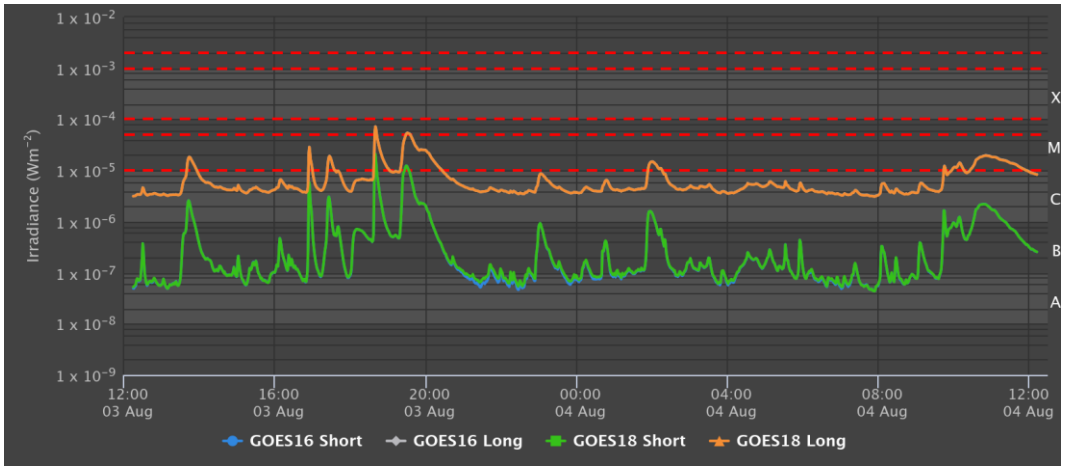
Radio Blackouts - X-Ray Flares:

An active disc, with thirteen sunspot regions currently on the visible disc, with two new regions developing - one in the northwest and the other just south of AR3774. Near the southwest limb, AR3765, AR3766 and AR3767 remain clustered close together. AR3765 and AR3767 are still in very close proximity, with the respective trailing and leading portions sharing a penumbra with a delta spot configuration. These regions are increasingly difficult to analyse as they approach the limb, with classification being maintained for the time being. AR3772 in the southeast maintains a strong delta in one of its intermediate spots. AR3774 in the southeast quadrant has lost its magnetic complexity. The leading and trailing spots on AR3775 are pulling apart, with the delta spot also having pulled apart. AR3777 has continued to develop with signs of minor growth in its trailing and intermediate spots, although this region is still difficult to analyse due its location. There are also hints of a further new region to rotate onto the southeast limb shortly. All other regions appear generally stable at present.

Far-side sounding data suggests the potential for at least one significant oncoming region by the end of this guidance period. Provisionally a slight drop in flare risk is suggested through Days 3-4 (06-07 Aug) as the cluster of active regions in the west leave the disc, although oncoming regions could potentially balance this decline. Overall Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares given the large number of complex active regions currently on the disc and activity over recent days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	90	80	70	70
Very Active	R3 to R5 X Class	No	25	20	20	20

Figure 3: GOES18 X-Ray flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background levels but has the potential to rise in response to any notable flares on the disc, particularly those from the west of the disc and therefore in a favourable position to give proton enhancement from any significant flare activity. This brings a chance of reaching the S1/Minor Radiation Storm levels, reducing slightly by the end of the period as active regions in the west increasingly rotate away.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	25	25	25	20
Very Active	**≥ S3 ***	No	5	5	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, is currently at background levels having been suppressed by recent CME arrivals. Further CME arrivals are likely to keep the observed flux near background levels in the short term, but recent CME activity is likely to have caused an increase in electron flux below GEO. Assuming CME influence wanes during the period (an assumption where confidence is low), this will probably be reflected in an increase in electron flux later in the period, with moderate or perhaps high flux becoming possible at the diurnal peak on Days 2-4 (05-07 Aug).

The associated 24hr electron fluence is most likely to remain below Active (1e8 integrated pfu), although with the potential for a rising trend during the period. MOSWOC REFM output suggests below Active through the period, which is reasonable, but confidence becomes increasingly low.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.